第四单元训练指导书

训练目的

- 掌握 UML 类图、顺序图、状态图的概念与要点，能够根据 UML 图提取信息；
- 掌握 StarUML 的基本使用方法，并能够绘制相关 UML 图；
- 掌握 mdj 文件与 UML 图的联系，能够从 mdj 文件中提取 UML 图的相关信息。

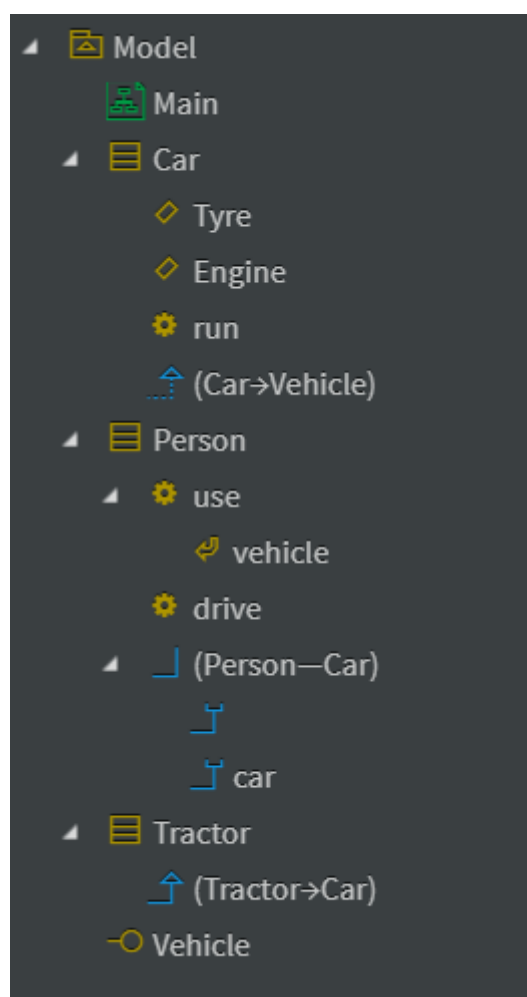## 训练任务

本次训练部分将包含如下三个部分的训练题：

1. 类图训练题
2. 顺序图训练题
3. 状态图训练题

每个训练题部分包含 4 个大题，各大题下有若干个小题。同学们需要根据题目给出的信息，完成相关问题的填写。答案提交方式请参考后文 **提交方式** 章节。
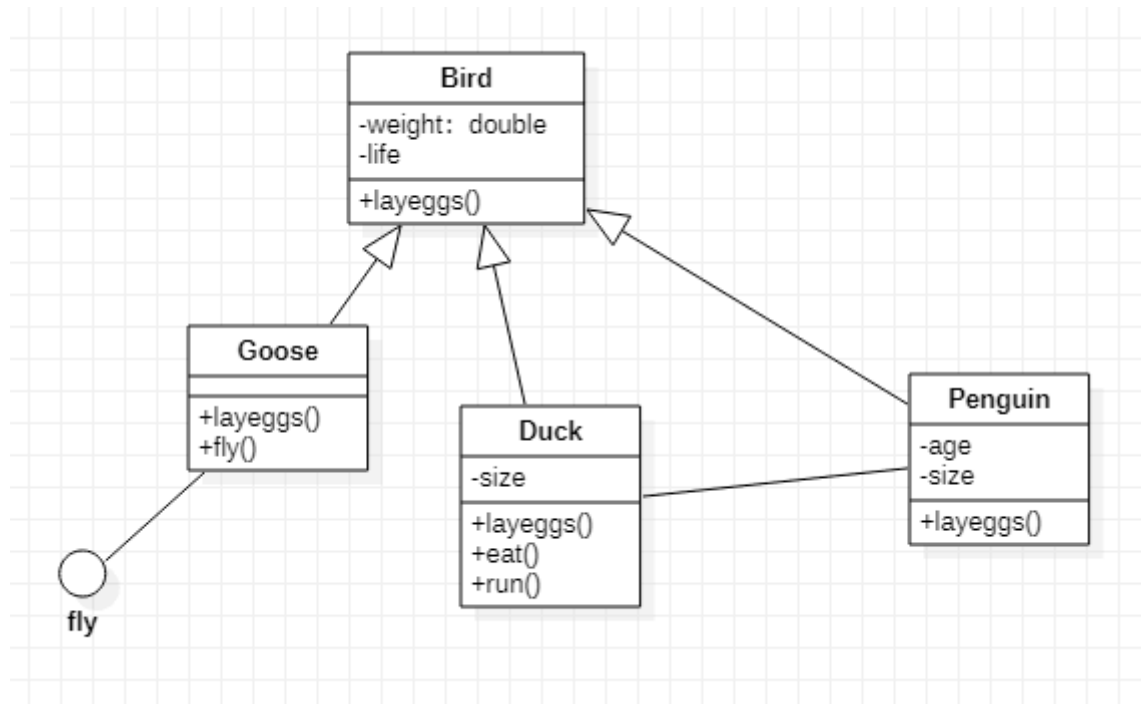
类图训练题

题目 1

根据树形图回答问题。

1. 类 `car` 有_____个属性，有_____个方法。

2. 类 `Car` 与类_____有关联关系。

3. 图中唯一的继承关系为由类_____继承类_____，唯一的实现关系为由类_____实现接口

_____。

题目 2

根据 UML 图回答问题。

1. 图中共有_____个类，其中类 `Duck` 有_____个方法。

2. 图中共有_____个继承关系。

3. 类 `Penguin` 有_____个属性。

4. 图中唯一的实现关系为类_____实现接口_____。

题目 3

根据给出的部分源代码回答问题。

```
1  {"_parent":"AAAAAAFF+qBWK6M3Z8Y=","visibility":"public","name":"Elevator","_type":"_____","_id":"AAAAAAF18DIKq2p6jLg="}
2  {"_parent":"AAAAAAF18DIKq2p6jLg=","visibility":"private","name":"capacity","_type":"UMLAttribute","_id":"AAAAAAF18DWCwGqkohY=","type":"int"}
3  {"_parent":"AAAAAAF18DZ3TWqvODQ=","name":"floor","_type":"UMLParameter","_id":"AAAAAAF18DbrIGq2/fc=","type": "int", "direction":"in"}
4  {"_parent":"AAAAAAF18DIKq2p6jLg=","visibility":"public","name":"move","_type":"UMLOperation","_id":"AAAAAAF18DZ3TWqvODQ="}
5  {"_parent":"_____","_type":"UMLParameter","_id":"AAAAAAF18DdF62q6Yis=","type":boolean,"direction":"return"}
```

上述源码表示的是类 `Elevator` 的属性方法，那么源码中缺失部分应该依次填入_____、_____。

题目 4

根据给出的部分 mdj 源码回答问题。

```json
{
    "_type": "UMLClass",
    "_id": "AAAAAAF8H/qgZRvLPsk=",
    "_parent": {
        "$ref": "AAAAAAFF+qBWK6M3Z8Y="
    },
    "name": "User"
},
{
    "_type": "UMLClass",
    "_id": "AAAAAAF8H/sG3hv1F3I=",
    "_parent": {
        "$ref": "AAAAAAFF+qBWK6M3Z8Y="
    },
    "name": "Reader",
    "ownedElements": [
        {
            "_type": "UMLGeneralization",
            "_id": "AAAAAAF8IAI3RRy6DZA=",
            "_parent": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "source": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "target": {
                "$ref": "AAAAAAF8H/qgZRvLPsk="
            }
        },
        {
            "_type": "UMLInterfaceRealization",
            "_id": "AAAAAAF8IAZXmR1ubio=",
            "_parent": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "source": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "target": {
                "$ref": "AAAAAAF8IAL7zhzeScg="
            }
        },
        {
            "_type": "UMLAssociation",
            "_id": "AAAAAAF8IApPMx7ZnGU=",
            "_parent": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "end1": {
                "_type": "UMLAssociationEnd",
                "_id": "AAAAAAF8IApPMx7aBiM=",
                "_parent": {
                    "$ref": "AAAAAAF8IApPMx7ZnGU="
```

```json
                },
                "reference": {
                    "$ref": "AAAAAAF8H/sG3hv1F3I="
                },
                "multiplicity": "1"
            },
            "end2": {
                "_type": "UMLAssociationEnd",
                "_id": "AAAAAAF8IApPMx7bfds=",
                "_parent": {
                    "$ref": "AAAAAAF8IApPMx7ZnGU="
                },
                "reference": {
                    "$ref": "AAAAAAF8IAUt1B0nQ00="
                },
                "multiplicity": "1"
            }
        }
    ],
    "operations": [
        {
            "_type": "UMLOperation",
            "_id": "AAAAAAF8IAabQh2ARXw=",
            "_parent": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "name": "renew"
        },
        {
            "_type": "UMLOperation",
            "_id": "AAAAAAF8IAbcWR2H8PE=",
            "_parent": {
                "$ref": "AAAAAAF8H/sG3hv1F3I="
            },
            "name": "return"
        }
    ]
},
{
    "_type": "UMLClass",
    "_id": "AAAAAAF8H/tpCRwfVJg=",
    "_parent": {
        "$ref": "AAAAAAFF+qBWK6M3Z8Y="
    },
    "name": "Administrator",
    "ownedElements": [
        {
            "_type": "UMLGeneralization",
            "_id": "AAAAAAF8IAJxuRzLMg4=",
            "_parent": {
                "$ref": "AAAAAAF8H/tpCRwfVJg="
            },
            "source": {
                "$ref": "AAAAAAF8H/tpCRwfVJg="
            },
            "target": {
                "$ref": "AAAAAAF8H/qgZRvLPsk="
            }
        }
```

```
112              },
113              {
114                  "_type": "UMLAssociation",
115                  "_id": "AAAAAAF8IAkUIh5Mpgs=",
116                  "_parent": {
117                      "$ref": "AAAAAAF8H/tpCRwfVJg="
118                  },
119                  "end1": {
120                      "_type": "UMLAssociationEnd",
121                      "_id": "AAAAAAF8IAkUIh5NZaU=",
122                      "_parent": {
123                          "$ref": "AAAAAAF8IAkUIh5Mpgs="
124                      },
125                      "reference": {
126                          "$ref": "AAAAAAF8H/tpCRwfVJg="
127                      },
128                      "multiplicity": "1..*"
129                  },
130                  "end2": {
131                      "_type": "UMLAssociationEnd",
132                      "_id": "AAAAAAF8IAkUIh5O8UI=",
133                      "_parent": {
134                          "$ref": "AAAAAAF8IAkUIh5Mpgs="
135                      },
136                      "reference": {
137                          "$ref": "AAAAAAF8H/sG3hv1F3I="
138                      }
139                  }
140              }
141          ]
142  },
143  {
144      "_type": "UMLInterface",
145      "_id": "AAAAAAF8IAL7zhzeScg=",
146      "_parent": {
147          "$ref": "AAAAAAFF+qBWK6M3Z8Y="
148      },
149      "name": "Borrow",
150      "attributes": [
151          {
152              "_type": "UMLAttribute",
153              "_id": "AAAAAAF8IANCBR0JmzM=",
154              "_parent": {
155                  "$ref": "AAAAAAF8IAL7zhzeScg="
156              },
157              "name": "book_id",
158              "type": ""
159          },
160          {
161              "_type": "UMLAttribute",
162              "_id": "AAAAAAF8IAO/Qx0QcJs=",
163              "_parent": {
164                  "$ref": "AAAAAAF8IAL7zhzeScg="
165              },
166              "name": "id",
167              "type": ""
168          }
169      ],
```

```json
      "operations": [
          {
              "_type": "UMLOperation",
              "_id": "AAAAAAF8IAQ5qB0Xl8c=",
              "_parent": {
                  "$ref": "AAAAAAF8IAL7zhzeScg="
              },
              "name": "renew"
          },
          {
              "_type": "UMLOperation",
              "_id": "AAAAAAF8IASCgx0fMBA=",
              "_parent": {
                  "$ref": "AAAAAAF8IAL7zhzeScg="
              },
              "name": "return"
          }
      ]
},
{
      "_type": "UMLClass",
      "_id": "AAAAAAF8IAUt1B0nQ00=",
      "_parent": {
          "$ref": "AAAAAAFF+qBWK6M3Z8Y="
      },
      "name": "Book",
      "attributes": [
          {
              "_type": "UMLAttribute",
              "_id": "AAAAAAF8IAVOGx1RaEo=",
              "_parent": {
                  "$ref": "AAAAAAF8IAUt1B0nQ00="
              },
              "name": "id",
              "visibility": "private"
          },
          {
              "_type": "UMLAttribute",
              "_id": "AAAAAAF8IAV38x1Z4h0=",
              "_parent": {
                  "$ref": "AAAAAAF8IAUt1B0nQ00="
              },
              "name": "name",
              "visibility": "public"
          },
          {
              "_type": "UMLAttribute",
              "_id": "AAAAAAF8IAWPGx1gfcI=",
              "_parent": {
                  "$ref": "AAAAAAF8IAUt1B0nQ00="
              },
              "name": "author",
             "visibility": "public"
          },
          {
              "_type": "UMLAttribute",
              "_id": "AAAAAAF8IAXZTh1nLug=",
              "_parent": {
```

```
228              "$ref": "AAAAAAF8IAUt1B0nQ00="
229          },
230          "name": "price",
231          "visibility": "public"
232        }
233      ]
234 }
```

1. 在代码中共有_____个关联关系，其中对端个数为一对多的两个相互关联的类为类_____和类
   _____。（第一个空填被关联的类）
2. 类 `Book` 一共有_____个属性，其中属性 `name` 的可见性为_____，属性 `id` 的可见性为
   _____。

顺序图训练题

题目 5

根据 UML 图回答问题。
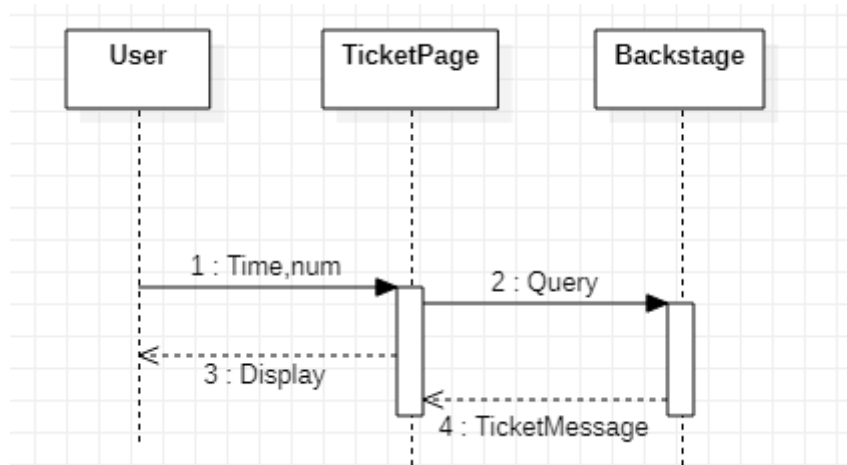
1. 图中共有_____个生命线，_____个消息。
2. 图中类型为返回消息的消息是_____和_____。（填数字）

题目 6

根据下方的树形图回答问题。
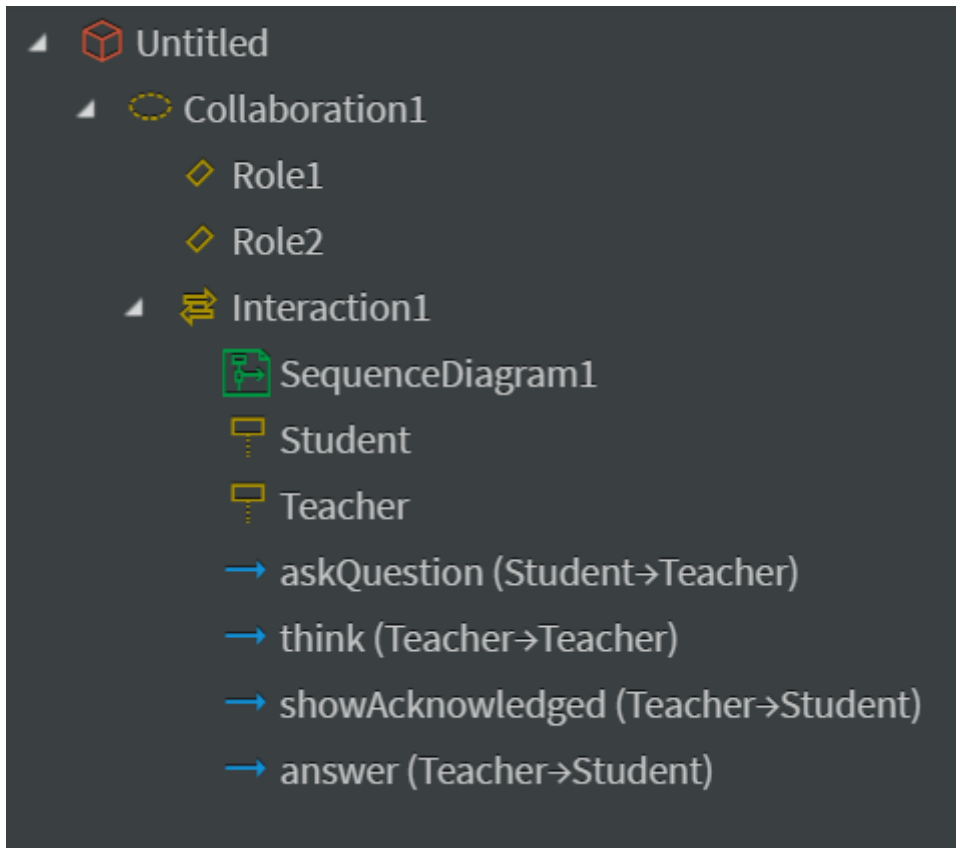
1. 两条生命线的名字分别为_____和_____。
2. 消息 `showAcknowledged` 的方向是从_____到_____。
3. 基于上图中的图符类别来推理，`Role1` 和 `Role2` 在 mdj 中的 `_type` 字段为_____。

题目 7

根据给出的部分 mdj 源码回答问题。

```json
{
    "_type": "UMLModel",
    "_id": "AAAAAAFF+qBWK6M3Z8Y=",
    "_parent": {
        "$ref": "AAAAAAFF+h6SjaM2Hec="
    },
    "name": "Model",
    "ownedElements": [
        {
            "_type": "UMLClassDiagram",
            "_id": "AAAAAAFF+qBtyKM79qY=",
            "_parent": {
                "$ref": "AAAAAAFF+qBWK6M3Z8Y="
            },
            "name": "Main",
            "defaultDiagram": true
        },
        {
            "_type": "UMLCollaboration",
            "_id": "AAAAAAF8Jhs5paF768E=",
            "_parent": {
                "$ref": "AAAAAAFF+qBWK6M3Z8Y="
            },
            "name": "Collaboration1",
            "ownedElements": [
```

```json
                    {
                        "_type": "UMLInteraction",
                        "_id": "AAAAAAF8Jhs5paF8Srs=",
                        "_parent": {
                            "$ref": "AAAAAAF8Jhs5paF768E="
                        },
                        "name": "Interaction1",
                        "ownedElements": [],
                        "messages": [
                            {
                                "_type": "UMLMessage",
                                "_id": "AAAAAAF8JiCnTaHtsGU=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "Order",
                                "source": {
                                    "$ref": "AAAAAAF8JhtBsaGLrOc="
                                },
                                "target": {
                                    "$ref": "AAAAAAF8Jhwvv6GtYrA="
                                }
                            },
                            {
                                "_type": "UMLMessage",
                                "_id": "AAAAAAF8JiRMlKIEeBw=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "Notice",
                                "source": {
                                    "$ref": "AAAAAAF8Jhwvv6GtYrA="
                                },
                                "target": {
                                    "$ref": "AAAAAAF8Jh3FpaHNxNg="
                                }
                            },
                            {
                                "_type": "UMLMessage",
                                "_id": "AAAAAAF8JiqGBaI+A2s=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "make",
                                "source": {
                                    "$ref": "AAAAAAF8Jh3FpaHNxNg="
                                },
                                "target": {
                                    "$ref": "AAAAAAF8Jh3FpaHNxNg="
                                }
                            },
                            {
                                "_type": "UMLMessage",
                                "_id": "AAAAAAF8Ji1OxKKZog4=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "Sent",
```

```json
                                "source": {
                                    "$ref": "AAAAAAF8Jhwvv6GtYrA="
                                },
                                "target": {
                                    "$ref": "AAAAAAF8JhtBsaGLrOc="
                                },
                                "messageSort": "reply"
                            }
                        ],
                        "participants": [
                            {
                                "_type": "UMLLifeline",
                                "_id": "AAAAAAF8JhtBsaGLrOc=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "Customer",
                                "represent": {
                                    "$ref": "AAAAAAF8JhtBsaGK3FU="
                                },
                                "isMultiInstance": false
                            },
                            {
                                "_type": "UMLLifeline",
                                "_id": "AAAAAAF8Jhwvv6GtYrA=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "Waiter",
                                "represent": {
                                    "$ref": "AAAAAAF8Jhwvv6GsGtY="
                                },
                                "isMultiInstance": false
                            },
                            {
                                "_type": "UMLLifeline",
                                "_id": "AAAAAAF8Jh3FpaHNxNg=",
                                "_parent": {
                                    "$ref": "AAAAAAF8Jhs5paF8Srs="
                                },
                                "name": "Cook",
                                "represent": {
                                    "$ref": "AAAAAAF8Jh3FpaHMEog="
                                },
                                "isMultiInstance": false
                            }
                        ]
                    }
                ],
                "attributes": [
                    {
                        "_type": "UMLAttribute",
                        "_id": "AAAAAAF8JhtBsaGK3FU=",
                        "_parent": {
                            "$ref": "AAAAAAF8Jhs5paF768E="
                        },
                        "name": "Role1"
                    },
```

```
142                    {
143                        "_type": "UMLAttribute",
144                        "_id": "AAAAAAF8Jhwvv6GsGtY=",
145                        "_parent": {
146                            "$ref": "AAAAAAF8Jhs5paF768E="
147                        },
148                        "name": "Role2"
149                    },
150                    {
151                        "_type": "UMLAttribute",
152                        "_id": "AAAAAAF8Jh3FpaHMEog=",
153                        "_parent": {
154                            "$ref": "AAAAAAF8Jhs5paF768E="
155                        },
156                        "name": "Role3"
157                    }
158                ]
159            }
```

1. 名为 `Sent` 的消息，`id` 为_____，类型为_____，其 `source` 对应的生命线为_____，`target` 对应的生命线为_____。（生命线填名字）
2. 生命线 `waiter` 总共有_____个发出的消息，_____个收到的消息。

题目 8

补全下面缺失部分的代码，其中消息 `Purchasinglist` 的意思是操作员向管理员发送购买清单消息。

```
1   {"_parent":"AAAAAAF8J/Igtxx8G1I=","visibility":"public","name":"Interaction1"
    ,"_type":"UMLInteraction","_id":"AAAAAAF8J/IguBx9v0w="}
2   {"messageSort":"synchCall","_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"pub
    lic","name":"Purchasinglist","_type":"UMLMessage","_id":"AAAAAAF8J/ZQoRztLuI=
    ","source":"_____","target":"_____"}
3   {"messageSort":"synchCall","_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"pub
    lic","name":"Buygoods","_type":"UMLMessage","_id":"AAAAAAF8J/egOx0EW3k=","sou
    rce":"AAAAAAF8J/JOmByszSg=","target":"AAAAAAF8J/KUQhzNu4Y="}
4   {"messageSort":"synchCall","_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"pub
    lic","name":"Reject","_type":"UMLMessage","_id":"AAAAAAF8KABjbh6iBFg=","sourc
    e":"AAAAAAF8J/KUQhzNu4Y=","target":"AAAAAAF8KABjbh6gBJU="}
5   {"messageSort":"synchCall","_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"pub
    lic","name":"Check","_type":"UMLMessage","_id":"AAAAAAF8J/wy/B5MmBO=","source
    ":"AAAAAAF8J/JOmByszSg=","target":"AAAAAAF8J/KUQhzNu4Y="}
6   {"_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"public","name":"Operator","_t
    ype":"_____","isMultiInstance":false,"_id":"AAAAAAF8J/Iu8xyM5no=","represen
    t":"AAAAAAF8J/Iu8hyLhZ8="}
7   {"_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"public","name":"Administrator
    ","_type":"UMLLifeline","isMultiInstance":false,"_id":"AAAAAAF8J/JOmByszSg=",
    "represent":"AAAAAAF8J/JOmByrDNI="}
8   {"_parent":"AAAAAAF8J/IguBx9v0w=","visibility":"public","name":"Supplier","_t
    ype":"UMLLifeline","isMultiInstance":false,"_id":"AAAAAAF8J/KUQhzNu4Y=","repr
    esent":"AAAAAAF8J/KUQhzMTkU="}
9   {"_parent":"_____","visibility":"public","name":"Endpoint1","_type":"UMLEnd
    point","_id":"AAAAAAF8KABjbh6gBJU="}
```

缺失部分应该依次填入_____、_____、_____、_____。

状态图训练题

题目 9

根据树形图回答问题。
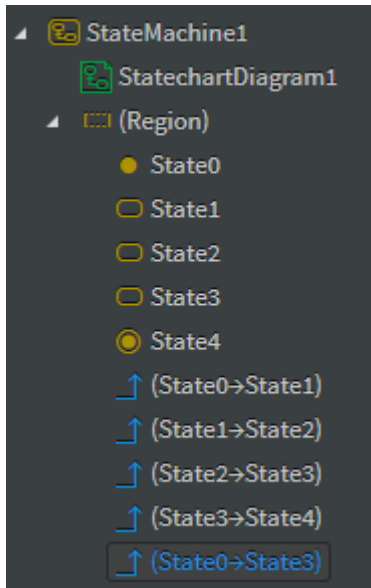
1. 图中一共有_____个 `UMLTransition` 。
2. 终止状态名称为_____，起始状态名称为_____。
3. 图中 `State1` 状态的可到达状态集合为 {_____}。（按照名称字母序升序排列）

题目 10

读下方的 UML 图，回答问题。图中起始状态名字为 1，最终状态名字为 7。
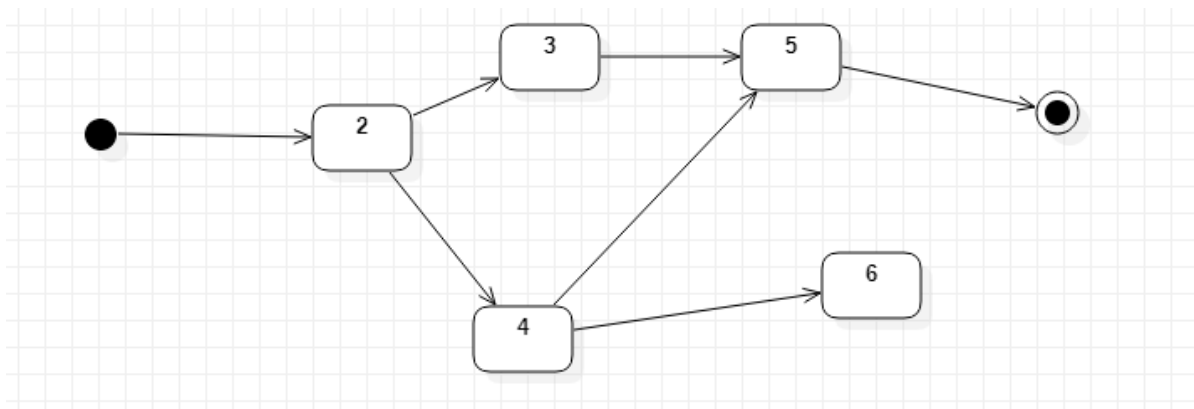
1. 图中共有_____个 `UMLTransition` 。
2. 状态 4 可以到达的状态集合为 {_____}，状态 2 可以直接到达的状态集合为 {_____}。

题目 11

读下方的 UML 源码，回答问题。

```
1    {
2        "_type": "UMLStateMachine",
3        "_id": "AAAAAAF8amEXEE4bBdo=",
4        "_parent": {
5            "$ref": "AAAAAAFF+h6SjaM2Hec="
6        },
7        "name": "StateMachine1",
8        "regions": [
```

```json
              {
                  "_type": "UMLRegion",
                  "_id": "AAAAAAF8amEXEE4cd04=",
                  "_parent": {
                      "$ref": "AAAAAAF8amEXEE4bBdo="
                  },
                  "vertices": [
                      {
                          "_type": "UMLState",
                          "_id": "AAAAAAF8amJGfU4i+bw=",
                          "_parent": {
                              "$ref": "AAAAAAF8amEXEE4cd04="
                          },
                          "name": "Login prompt"
                      },
                      {
                          "_type": "UMLState",
                          "_id": "AAAAAAF8amMxJk40L9E=",
                          "_parent": {
                              "$ref": "AAAAAAF8amEXEE4cd04="
                          },
                          "name": "verification"
                      },
                      {
                          "_type": "UMLState",
                          "_id": "AAAAAAF8amPFLk5b8mY=",
                          "_parent": {
                              "$ref": "AAAAAAF8amEXEE4cd04="
                          },
                          "name": "Loginfail"
                      },
                      {
                          "_type": "UMLState",
                          "_id": "AAAAAAF8amRlM06BEJs=",
                          "_parent": {
                              "$ref": "AAAAAAF8amEXEE4cd04="
                          },
                          "name": "ModifyPassword"
                      },
                      {
                          "_type": "UMLState",
                          "_id": "AAAAAAF8amSevU6oWGg=",
                          "_parent": {
                              "$ref": "AAAAAAF8amEXEE4cd04="
                          },
                          "name": "Success"
                      }
                  ],
                  "transitions": [
                      {
                          "_type": "UMLTransition",
                          "_id": "AAAAAAF8amVXuE7TpcQ=",
                          "_parent": {
                              "$ref": "AAAAAAF8amEXEE4cd04="
                          },
                          "source": {
                              "$ref": "AAAAAAF8amJGfU4i+bw="
                          },
```

```json
                            "target": {
                                "$ref": "AAAAAAF8amMxJk40L9E="
                            },
                            "stereotype": "",
                            "triggers": [
                                {
                                    "_type": "UMLEvent",
                                    "_id": "AAAAAAF8ampks09cSG8=",
                                    "_parent": {
                                        "$ref": "AAAAAAF8amVXuE7TpcQ="
                                    },
                                    "name": "Login"
                                }
                            ]
                        },
                        {
                            "_type": "UMLTransition",
                            "_id": "AAAAAAF8amWFS07nrGw=",
                            "_parent": {
                                "$ref": "AAAAAAF8amEXEE4cd04="
                            },
                            "source": {
                                "$ref": "AAAAAAF8amMxJk40L9E="
                            },
                            "target": {
                                "$ref": "AAAAAAF8amPFLk5b8mY="
                            }
                        },
                        {
                            "_type": "UMLTransition",
                            "_id": "AAAAAAF8amWbfk7460Y=",
                            "_parent": {
                                "$ref": "AAAAAAF8amEXEE4cd04="
                            },
                            "source": {
                                "$ref": "AAAAAAF8amMxJk40L9E="
                            },
                            "target": {
                                "$ref": "AAAAAAF8amSevU6oWGg="
                            }
                        },
                        {
                            "_type": "UMLTransition",
                            "_id": "AAAAAAF8amXB0U8JsxM=",
                            "_parent": {
                                "$ref": "AAAAAAF8amEXEE4cd04="
                            },
                            "source": {
                                "$ref": "AAAAAAF8amPFLk5b8mY="
                            },
                            "target": {
                                "$ref": "AAAAAAF8amJGfU4i+bw="
                            },
                            "triggers": [
                                {
                                    "_type": "UMLEvent",
                                    "_id": "AAAAAAF8amwKvU9lnws=",
                                    "_parent": {
```

```
125                                    "$ref": "AAAAAAF8amXBOU8JsxM="
126                                },
127                                "name": "Fail"
128                            }
129                        ],
130                        "effects": [
131                            {
132                                "_type": "UMLOpaqueBehavior",
133                                "_id": "AAAAAAF8amxYVk9p/9s=",
134                                "_parent": {
135                                    "$ref": "AAAAAAF8amXBOU8JsxM="
136                                },
137                                "name": "Retry"
138                            }
139                        ]
140                    },
141                    {
142                        "_type": "UMLTransition",
143                        "_id": "AAAAAAF8amYeCE8bD9E=",
144                        "_parent": {
145                            "$ref": "AAAAAAF8amEXEE4cd04="
146                        },
147                        "source": {
148                            "$ref": "AAAAAAF8amPFLk5b8mY="
149                        },
150                        "target": {
151                            "$ref": "AAAAAAF8amRlMO6BEJs="
152                        },
153                        "triggers": [
154                            {
155                                "_type": "UMLEvent",
156                                "_id": "AAAAAAF8am3ImU9vj7I=",
157                                "_parent": {
158                                    "$ref": "AAAAAAF8amYeCE8bD9E="
159                                },
160                                "name": "ForgetWord"
161                            }
162                        ]
163                    },
164                    {
165                        "_type": "UMLTransition",
166                        "_id": "AAAAAAF8amYn+k8sgdY=",
167                        "_parent": {
168                            "$ref": "AAAAAAF8amEXEE4cd04="
169                        },
170                        "source": {
171                            "$ref": "AAAAAAF8amRlMO6BEJs="
172                        },
173                        "target": {
174                            "$ref": "AAAAAAF8amJGfU4i+bw="
175                        },
176                        "guard": "modify()"
177                    },
178                    {
179                        "_type": "UMLTransition",
180                        "_id": "AAAAAAF8am6FOk9zAWY=",
181                        "_parent": {
182                            "$ref": "AAAAAAF8amEXEE4cd04="
```

```
183                            },
184                            "source": {
185                                "$ref": "AAAAAAF8amSevU6oWGg="
186                            },
187                            "target": {
188                                "$ref": "AAAAAAF8amJGfU4i+bw="
189                            },
190                            "guard": "loginout()",
191                            "triggers": [
192                                {
193                                    "_type": "UMLEvent",
194                                    "_id": "AAAAAAF8am6ns0+EEFg=",
195                                    "_parent": {
196                                        "$ref": "AAAAAAF8am6FOk9zAWY="
197                                    },
198                                    "name": "Exit"
199                                }
200                            ]
201                        }
202                    ]
203                }
204            ]
205    }
```

1. 图中一共有_____个 `UMLTransition`，其中有_____个 `UMLTransition` 有事件标识（`UMLEvent`）。

2. 拥有 `UMLOpaqueBehavior` 的 `UMLTransition` 的 `id` 为_____，其 `source` 对应的状态为_____，`target` 对应的状态为_____。（填名称）

3. 从状态 ModifyPassword 到状态 Login prompt 的守护条件（`guard`）为_____。

题目 12

根据给出的部分 mdj 源码回答问题。

```
1    {
2        "_type": "UMLStateMachine",
3        "_id": "AAAAAAF8apVT71MJ7Ng=",
4        "_parent": {
5            "$ref": "AAAAAAFF+h6SjaM2Hec="
6        },
7        "name": "StateMachine1",
8        "regions": [
9            {
10                "_type": "UMLRegion",
11                "_id": "AAAAAAF8apVT71MKSos=",
12                "_parent": {
13                    "$ref": "AAAAAAF8apVT71MJ7Ng="
14                },
15                "vertices": [
16                    {
17                        "_type": "UMLPseudostate",
18                        "_id": "AAAAAAF8apWUrFMQq48=",
19                        "_parent": {
20                            "$ref": "AAAAAAF8apVT71MKSos="
21                        },
22                        "kind": "initial"
```

```json
                },
                {
                    "_type": "UMLFinalState",
                    "_id": "AAAAAAF8apWbhlMhac4=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    }
                },
                {
                    "_type": "UMLState",
                    "_id": "AAAAAAF8apWpu1MmkwA=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    },
                    "name": "State1"
                },
                {
                    "_type": "UMLState",
                    "_id": "AAAAAAF8apWwcFNLSv8=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    },
                    "name": "State2"
                },
                {
                    "_type": "UMLState",
                    "_id": "AAAAAAF8apccN1NwPiQ=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    },
                    "name": "State3"
                },
                {
                    "_type": "UMLState",
                    "_id": "AAAAAAF8apcillOVr8k=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    },
                    "name": "State4"
                },
                {
                    "_type": "UMLState",
                    "_id": "AAAAAAF8apcpmVO6TbQ=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    },
                    "name": "State5"
                }
            ],
            "transitions": [
                {
                    "_type": "UMLTransition",
                    "_id": "AAAAAAF8apnO91PfLX4=",
                    "_parent": {
                        "$ref": "AAAAAAF8apVT71MKSos="
                    },
                    "source": {
                        "$ref": "AAAAAAF8apWUrFMQq48="
```

```json
                },
                "target": {
                    "$ref": "AAAAAAF8apWpu1MmkwA="
                }
            },
            {
                "_type": "UMLTransition",
                "_id": "AAAAAAF8apnjm1PwoVE=",
                "_parent": {
                    "$ref": "AAAAAAF8apVT71MKSos="
                },
                "source": {
                    "$ref": "AAAAAAF8apWUrFMQq48="
                },
                "target": {
                    "$ref": "AAAAAAF8apWwcFNLSv8="
                }
            },
            {
                "_type": "UMLTransition",
                "_id": "AAAAAAF8apnujlQB9Sw=",
                "_parent": {
                    "$ref": "AAAAAAF8apVT71MKSos="
                },
                "source": {
                    "$ref": "AAAAAAF8apWpu1MmkwA="
                },
                "target": {
                    "$ref": "AAAAAAF8apccN1NwPiQ="
                }
            },
            {
                "_type": "UMLTransition",
                "_id": "AAAAAAF8apn3EFQSvPc=",
                "_parent": {
                    "$ref": "AAAAAAF8apVT71MKSos="
                },
                "source": {
                    "$ref": "AAAAAAF8apWwcFNLSv8="
                },
                "target": {
                    "$ref": "AAAAAAF8apccN1NwPiQ="
                }
            },
            {
                "_type": "UMLTransition",
                "_id": "AAAAAAF8apoCqVQj6NI=",
                "_parent": {
                    "$ref": "AAAAAAF8apVT71MKSos="
                },
                "source": {
                    "$ref": "AAAAAAF8apccN1NwPiQ="
                },
                "target": {
                    "$ref": "AAAAAAF8apcillOVr8k="
                }
            },
            {
```

```
139                    "_type": "UMLTransition",
140                    "_id": "AAAAAAF8apoKeFQ0X7A=",
141                    "_parent": {
142                        "$ref": "AAAAAAF8apVT71MKSos="
143                    },
144                    "source": {
145                        "$ref": "AAAAAAF8apccN1NwPiQ="
146                    },
147                    "target": {
148                        "$ref": "AAAAAAF8apcpmVO6TbQ="
149                    }
150                },
151                {
152                    "_type": "UMLTransition",
153                    "_id": "AAAAAAF8apoaJ1RFrYk=",
154                    "_parent": {
155                        "$ref": "AAAAAAF8apVT71MKSos="
156                    },
157                    "source": {
158                        "$ref": "AAAAAAF8apcil1OVr8k="
159                    },
160                    "target": {
161                        "$ref": "AAAAAAF8apWbhlMhac4="
162                    }
163                },
164                {
165                    "_type": "UMLTransition",
166                    "_id": "AAAAAAF8apokyFRWqkQ=",
167                    "_parent": {
168                        "$ref": "AAAAAAF8apVT71MKSos="
169                    },
170                    "source": {
171                        "$ref": "AAAAAAF8apcpmVO6TbQ="
172                    },
173                    "target": {
174                        "$ref": "AAAAAAF8apWbhlMhac4="
175                    }
176                }
177            ]
178        }
179    ]
180 }
```

该状态机的**关键状态**为＿＿＿＿＿＿＿＿（填名称，如果不存在**关键状态**则填无）。

对于**关键状态**的解释：

- 删除某个状态之后无法从 Initial State 到达任意一个 Final State，且不与下一条规定相悖，则该状态是关键状态。
- 如果状态机模型本来就无法从 Initial State 到达任意一个 Final State，则该状态机中所有状态都不是关键状态。

提交方式

注意到每一题有标注序号，根据下文给出的模板和参考示例（仅有格式参考作用，无实际含义）保存在第四单元训练仓库的根目录的 `answer.json` 文件内，并在 course 平台提交该 commit。

```json
{
    "1": [
        "第二题第一空内容",
        "第二题第二空内容",
        "第二题第三空内容",
        "第二题第四空内容",
        "第二题第五空内容",
        "第二题第六空内容",
        "第二题第七空内容"
    ],
    "2": [
        "第二题第一空内容",
        "第二题第二空内容",
        "第二题第三空内容",
        "第二题第四空内容",
        "第二题第五空内容",
        "第二题第六空内容"
    ],
    "3": ["第三题第一空内容", "第三题第二空内容"],
    "4": [
        "第四题第一空内容",
        "第四题第二空内容",
        "第四题第三空内容",
        "第四题第四空内容",
        "第四题第五空内容",
        "第四题第六空内容"
    ],
    "5": [
        "第五题第一空内容",
        "第五题第二空内容",
        "第五题第三空内容",
        "第五题第四空内容"
    ],
    "6": [
        "第六题第一空内容",
        "第六题第二空内容",
        "第六题第三空内容",
        "第六题第四空内容",
        "第六题第五空内容"
    ],
    "7": [
        "第七题第一空内容",
        "第七题第二空内容",
        "第七题第三空内容",
        "第七题第四空内容",
        "第七题第五空内容",
        "第七题第六空内容"
    ],
    "8": [
        "第八题第一空内容",
        "第八题第二空内容",
        "第八题第三空内容",
        "第八题第四空内容"
    ],
    "9": [
        "第九题第一空内容",
        "第九题第二空内容",
        "第九题第三空内容",
```

```json
          "第九题第四空内容"
      ],
      "10": ["第十题第一空内容", "第十题第二空内容", "第十题第三空内容"],
      "11": [
          "第十一题第一空内容",
          "第十一题第二空内容",
          "第十一题第三空内容",
          "第十一题第四空内容",
          "第十一题第五空内容",
          "第十一题第六空内容"
      ],
      "12": "第十二题第一空内容"
}
```